ISSUE 2/2017

X'PRESS

HOW TO COLLABORATE

Malvern PANalytical

The end of an era

Pieter de Groot
vice president Marketing, Malvern PANalytical

The current year 2017 is a memorable year for PANalytical: After almost 15 years of being PANalytical we have started the collaboration with Malvern to create the new company Malvern PANalytical. During the last half year we have already been able to undertake considerable steps towards one united company. New structures have been defined and realized and employees with different backgrounds and cultures have started working together with only one goal: to serve our customers better.

Later this year also changes in our appearance will be more obvious. This current issue of our X'Press magazine will be the last one in the familiar PANalytical form. Here, we have invited Paul Kippax, director of Product Management Morphology, to introduce this sector to PANalytical readers and familiarize them with a few aspects of the new company. We will continue to stay in contact with you by means of a magazine for all our customers where we will still introduce you to our solutions at customers' sites and inform you about the developments in Malvern PANalytical.

The merger has led us to look back onto our company's origins. PANalytical's history is very closely connected to the development of X-ray materials analysis and in many cases our predecessors stood at the cradle of a new instrument, which has become the standard in later years. We want to share these facts with you in the form of a series of six historical episodes, presenting an overview of discoveries and developments relevant for the making of Malvern PANalytical.
This issue includes a description of the pioneering days when scientists laid the base for today's state-of-the-art materials analysis and the sequels will show how science together with our new company have emerged during the years.

History shows that many discoveries have only been possible by the collaboration of (a number of) scientists. A regular exchange of ideas, discussions of controversial or problematic issues and a joint refinement of findings can ultimately lead to a breakthrough. This has always been PANalytical's and Malvern's style of collaborating with our customers (you find a few examples on the following pages) and it is one of the important common features of both companies. Combining these forces will make us your partner who wants to understand your challenges and assist you solving them.

I am very much looking forward to this joint future as Malvern PANalytical, a company committed to service you are already familiar with. Our dedicated specialists are ready for an excellent collaboration with you!

With kind regards,

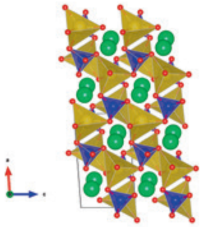
Pieter de Groot, vice president Marketing,
Malvern PANalytical

LATEST NEWS

High-quality powder diffraction data for much more than phase analysis…

Traditionally crystal structures are solved using single crystal diffraction. Many materials are, however, only available as powders. Since the first structure solution of $LiSbWO_6$ from powder diffraction data [Le Bail et al., Materials Research Bulletin 23, issue 3, (1988), 447-452] this has developed into an established technique suitable for any crystalline material.

The Malvern PANalytical portfolio provides both key components for a successful structure solution from powder data:
(i) excellent data quality from diffractometers with an optimized optical path and
(ii) the HighScore software suite with a set of proven tools and algorithms, required for a structure solution from powder data.



Crystal structure of $NaSrVO_4$ solved with data collected on PANalytical's Empyrean diffractometer

Learn more on www.panalytical.com/Solving-structures-from-powder-diffraction-data.htm

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8 The pioneering days

Sonia Holopainen with the Epsilon 3XLE

EDXRF in environmental ecological studies

The School of Pharmacy is part of the Faculty of Health Sciences at the Kuopio Campus of the University of Eastern Finland (UEF). Here, Dr. Sirpa Peräniemi has more than 30 years of experience of analyzing metals from various sources, like tissues, biochar, wood materials and other environmental samples. A couple of years ago a PANalytical Epsilon 3XLE energy dispersive X-ray fluorescence (EDXRF) spectrometer was purchased, which is mostly used to develop novel adsorbent materials for the purification of mine wastes. However, during these years UEF researchers have also used the instrument to analyze other environmental samples. Two applications have proven to be especially successful: analyses of the metal contents of boat bug elytra and the determination of the amount of sulfur and other elements in ant nests.

According to associate professor Jouni Sorvari, head of the Chemical and Microbial Ecology group, animals that stay in a relatively small area are good candidates for monitoring the trace metals in their ecosystem. Aquatic insects (like the boat bug) usually live most of their lives in one water body. Similarly, in a terrestrial environment, ants are bound to their nest and collect their food and nest material from the vicinity of this nest.

The measured samples include the insects' chitin cover wings, but also ground insects or nest material. Other samples were decomposed by acids and results from these liquid samples were compared to solid samples to get a better understanding of the real concentrations of the elements in the solid samples.

UEF's researchers used the Epsilon 3XLE X-ray fluorescence spectrometer to measure trace metals in insects and environmental samples in artificial storm water retention ponds in the city of Kuopio. In the aquatic insect samples at this location they found elevated levels of some metals, especially titanium. The highest levels were measured close to an area where a new housing area has recently been built.

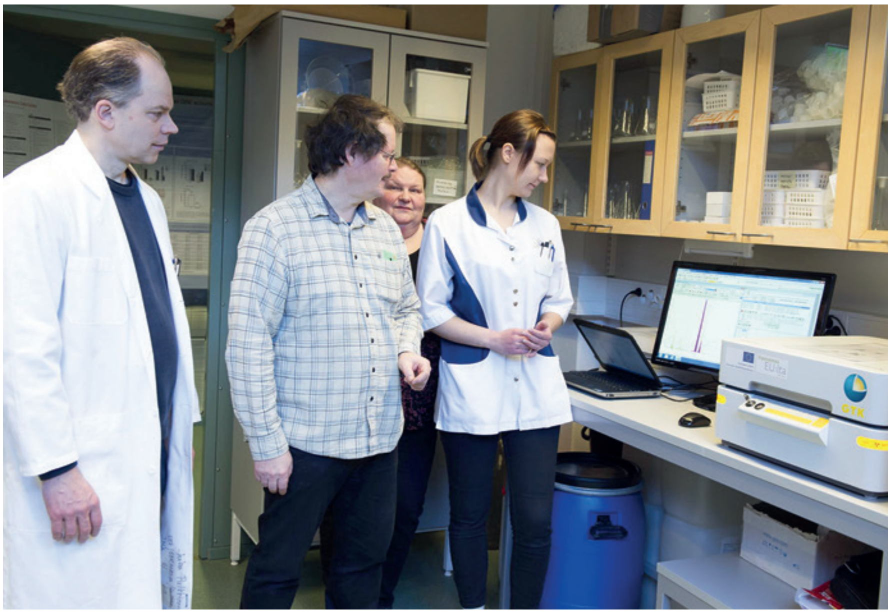
> **"With the Epsilon 3XLE we get results immediately and not only after days. We have often been wondering why we have not purchased this instrument earlier!"**
>
> *Prof. Jouko Vepsäläinen, head of Applied Chemistry and Metabolic Profiling at UEF's School of Pharmacy*

The results suggest that the building activities have caused the release of these metals. Pigments or paints are most probably the origin of the titanium contamination.

Another research project deals with the industrial area around a metal industry in Kokkola, Western Finland. Here, the researchers analyzed red wood ants (Formica lugubris) and their nest material such as needles and other organic particles. They found significant differences in the heavy metal contents of areas close to the industrial activities and areas further away. Especially levels of nickel, lead, zinc, cobalt and iron differed most significantly.

Since the measurement is fast and easy, the study of environmental sulfur concentrations from ants' nests has been carried out as students' project work in ecology. Quantitative results are obtained by using the addition method where known amounts of a sulfur solution are added to ground nest material. The results from these experiments are comparable to analyses from commercial laboratories.

A major project of UEF researchers is the development of chitosan-based sulfur adsorbents, which can remove sulfur from waste water in mines.



Left to right: Dr. Juha-Matti Aalto, Prof. Dr. Jouko Vepsäläinen, Dr. Sirpa Peräniemi and laboratory technician Sonja Holopainen

To find the best recipe, typically a large number of fresh waste water samples from mining sites or paper mills (containing from 40 to 10,000 mg of sulfur) needs to be analyzed. This screening process normally requires 30-50 different experiments and can now be finished within a couple of days when the Epsilon 3^{XLE} is taken on site to customer mines nearby. It is even possible to change piloting plans on the run if necessary because results from different experiments and test runs can immediately be compared without having to wait for several weeks. Once the instrument is calibrated for the studied water samples the results from the pilot sites are comparable to results obtained afterwards from commercial laboratories from the same samples.

UEF's research team members indicated that the rapid and easy analysis of these environmental samples provided by XRF is making their work considerably easier. More detailed studies are underway with the results being published later this year.

A typical setup of instruments during a sulfur removal pilot in a mine. Sulfur concentrations are analyzed in the nearby container.

UNIVERSITY OF
EASTERN FINLAND

The University of Eastern Finland (UEF) is one of the largest universities in Finland. Three campuses are home to approximately 15,000 students and 2,800 staff members. Their research activities are built around four global challenges (ageing, lifestyle and health, learning in a digitized society, cultural encounters, mobility and borders), environmental change and sufficiency of natural resources.

The Guatemalan Cementos Progreso S.A. provides construction materials such as cement, concrete, lime and other products and services related to construction.

In order to encourage research in industry as well as in academia, the company opened 24 years ago the Technological Center for Cement and Concrete (CETEC). CETEC's chemical laboratory is equipped with various technologies, among them X-ray diffraction (XRD), using PANalytical's Empyrean multipurpose X–ray diffractometer.

A fruitful collaboration to explore Mayan building materials

Maya civilization developed between 300 and 900 A.D. in a region that today is Eastern Mexico, Western Honduras, El Salvador and the whole of Belize and Guatemala. The Maya used stucco to cover interior and exterior surfaces of their buildings. At La Corona[1], a Classic period site in Guatemala's Petén department, archaeologists found significantly better preserved Mayan sculptures than those from other sites of the region.

In 2015, CETEC and the Universidad del Valle de Guatemala (UVG) decided to collaborate in a number of research projects. One of them is the analysis of construction materials used by the ancient inhabitants of La Corona. The collected chemical and mineralogical data should help to assess the quality of the limestone used as raw material for the applied stucco. For this research both X-ray fluorescence (XRF) and X-ray diffraction (XRD) techniques were used.

The results show that almost all analyzed stucco samples contain between 91 and 95 % of calcite ($CaCO_3$). Therefore the raw material used by the Maya for stucco production must have been a quality limestone with high calcite content, which could explain the good state of preservation of the sculptures. An exception is the earliest sample analyzed, which contains 85.25 % dolomitic limestone ($CaMg(CO_3)_2$).

cementos PROGRESO
Compartimos Sueños. Construimos Realidade

CENTRO DE INVESTIGACIONES ARQUEOLÓGICAS Y ANTROPOLÓGICAS
·CIAA·

1: More information about the La Corona Archaeological Project (Proyecto Regional Arqueológico La Corona, PRALC): http://mari.tulane.edu/PRALC

The researchers also observed that the stucco made from calcite has a yellowish hue whereas the dolomitic stucco is almost entirely white. This phenomenon is directly related to the yellowish limestone that was used as raw material.

Further research should reveal whether the selection of raw material or the stucco recipe used by the Maya are related to the chronology of the site or to the use of the material as coating for floors, walls and stairs or as decoration of building exteriors.

The purity of the limestone used as raw material will be determined in order to explain the good state of preservation. Comparison with data from nearby and contemporaneous sites could enable an identification of the patterns in the use of construction materials in different regions and periods of the Maya civilization.

The research team with their Empyrean diffractometer: Andrea Sandoval Molina (left), researcher at Centro de Investigaciones Arqueológicas y Antropológicas (CIAA) Universidad del Valle and (right) Elvis Geovanni García, lab analyst at Cementos Progreso

Stucco

The raw material for stucco is limestone (calcium carbonate, $CaCO_3$) which is turned into burnt lime by calcination. The addition of water yields calcium hydroxide, which is mixed with fillers to form stucco. The applied stucco slowly reabsorbs carbon dioxide when exposed to air to re-form calcium carbonate.

Dolomitic stucco (partly made from dolomite, $CaMg(CO_3)_2$) is generally less stable than stucco mostly made out of calcite and can get fractures during the drying process. This way, the durability depends (partly) on the raw materials used for the stucco.

> **“The collaboration between CETEC and the UVG enables us to do archaeometric analyses we would otherwise not have been able to conduct here in Guatemala.”**
>
> *Andrea Sandoval, researcher at CIAA, UVG*

1917 - 1945

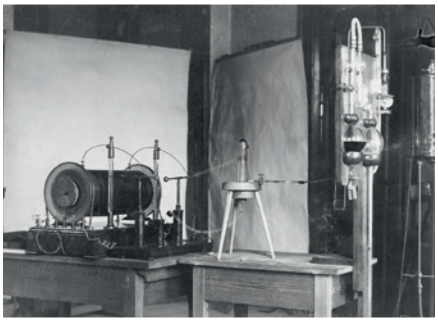
1945 - 1972

The pioneering days 1895 -1917

The late nineteenth and early twentieth century were exciting times for many scientists. Discoveries were made that laid the base for technologies we are presently taking for granted. One of the great breakthroughs in physics was the discovery of X-rays by Wilhelm Conrad Röntgen in 1895.

X-rays

On the evening of 8 November 1895, Prof. Wilhelm Conrad Röntgen was working late in his laboratory. He was busy experimenting with cathode rays in low-vacuum tubes when suddenly he saw a sheet of paper, painted with barium platinocyanide, glowing in the dark. He realized that he had discovered an unknown type of radiation, which he later named X-rays.



Röntgen's experiment
Courtesy of Deutsches Röntgen-Museum, Remscheid (Germany)

With a series of experiments Röntgen determined the physical properties of the newly discovered radiation. Already 7 weeks after his discovery, he published his first results in his paper 'Über eine neue Art von Strahlen' (On a new type of radiation).

X-ray tubes

EINZIGER PREIS GOLDENE MEDAILLE LONDON JULI 1901
verliehen für die Herstellung der besten Röntgen-Röhre, im Wettbewerb gegen englische, amerikanische u. deutsche Fabrikate.

ELECTRICITÄTS-WERKE
C.H.F. MÜLLER
SPECIAL-FABRIK FÜR RÖNTGEN-RÖHREN

Telegr. Adresse: FLORENZIUS HAMBURG
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Hamburg, den .... 190....

Briefkopf der Firma C. H. F. Müller aus der Zeit um 1900

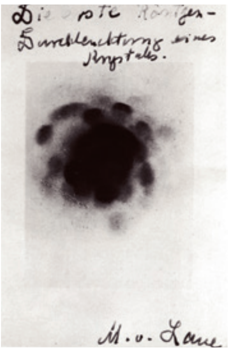
The news about Röntgen's discovery spread very quickly. In January 1896 Prof. B. Walter of the Hamburg State Laboratory asked glass manufacturer Carl Müller to make an X-ray tube like the one that Wilhelm Röntgen was using. With this tube he was able to make an X-ray picture of a hand just two weeks after Röntgen's paper.

Subsequently Walter and Müller started a collaboration to improve the quality of the X-ray tubes and developed among others the first water-cooled X-ray tube in 1899. It was then that Müller decided to extend his incandescent lamp factory with the development and production of X-ray tubes. Later he wrote in his memoirs: 'Mit Röntgen begann die Zukunft' (The future started with Röntgen).

X-ray diffraction

At first, the physical properties of X-rays were unknown. One of the objectives was to prove that they were a type of electromagnetic radiation, and if so, of which wavelength. In 1897, Herman Haga and Cornelis Wind (two physicists of the University of Groningen, the Netherlands) started to experiment with X-rays passing through a very narrow slit. The resulting diffraction pattern enabled them to determine the X-ray wavelength.

Years later, in 1912, Walter Friedrich, Paul Knipping and Max Laue performed X-ray diffraction experiments, using a copper sulfate crystal as lattice. The resulting picture, an X-ray photo with a set of black dots, was the start of a whole new field of research: X-ray crystallography.



Courtesy of Deutsches Röntgen-Museum, Remscheid (Germany)

In the same year, father and son William Henry and William Lawrence Bragg described a formula, known as Bragg's law, relating the lattice distances d in the crystal with the X-ray wavelength λ and the angle of incidence θ of the X-rays: $2d \sin\theta = n\lambda$.

1972 - 2002

2002 - 2017

Malvern PANalytical

2017 - …

Powder diffraction

The newly developed X-ray diffraction technique allowed the determination of crystal structures and lattice constants of all kinds of crystalline materials. It had, however, one big drawback: the samples had to be single crystalline to deliver a good diffractogram.

When in 1916 Peter Debye and Paul Scherrer worked together at the University of Göttingen (Germany) on the diffraction of 'arbitrarily oriented particles' they discovered that these samples also produced good diffraction patterns. They developed a camera, known as the Debye-Scherrer camera, which became a well-known tool in crystallography labs all over the world.

Less well-known is that Albert Hull of the General Electric Research Laboratories in Schenectady (NY, USA), developed a similar camera at the same time. Unfortunately, his publication became known in Europe only after the end of the First World War.

Foundations of PANalytical

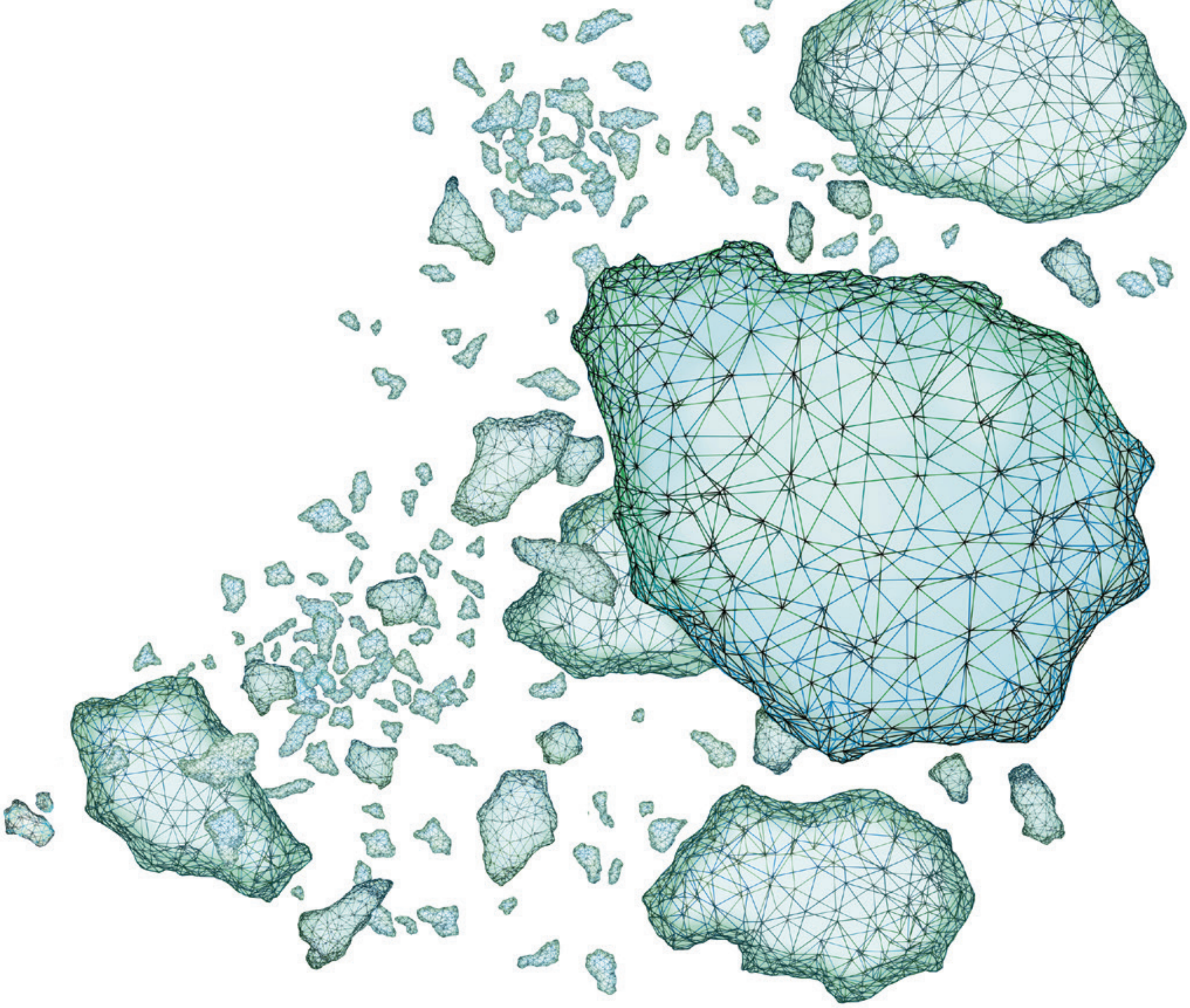
On 15 May 1891 Gerard Philips opened an incandescent lamp factory in the small town of Eindhoven in the southern part of the Netherlands. The company had a slow start with a lot of technical problems in the production process. Gerard Philips realized that research and development would play an increasingly important role in his company. In order to support the production of the incandescent lamps, Philips opened its own physical laboratory in 1914 - the 'nat lab'. The lab's first research director was Gilles Holst, a former student of Nobel laureate Heike Kamerlingh Onnes.

Atomic structure

One of the problems in physics at the start of the twentieth century was the description of the structure of an atom. Niels Bohr, a Danish professor from the University of Copenhagen published his article 'On the constitution of atoms and molecules' in 1913. At first, the article did not attract much attention, but, as Bohr remembered fifty years later: 'the great change came from Moseley'.

Henry Moseley was a researcher in the Cavendish laboratory in Manchester (UK), when he started to determine the X-ray spectra of the known elements in a systematic way. Already in 1908, Charles Barkla (University College Liverpool, UK), had discovered that each element could produce an X-ray spectrum with characteristic lines. Moseley coupled the characteristic lines to the energy levels as described by Niels Bohr. This research was fundamental for the field of X-ray spectroscopy.

Henry Moseley in his lab



Joining our forces

During the last months PANalytical and Malvern have closely worked together at the creation of Malvern PANalytical. But how can PANalytical customers benefit from this new company and what are the advantages of the merger for them? X'Press asked Paul Kippax, director Product Management Morphology about his role and his visions for the future of Malvern PANalytical.

Paul, could you explain to our readers the meaning of 'morphology' in the context of your position in Malvern PANalytical?

Generally morphology means the form and structure of something (it contains the Greek word morphē – form). At Malvern PANalytical the Morphology group employs physicochemical methods, which are designed to measure parameters such as particle and molecular size, particle shape, polymer structure and the flow properties of materials. This includes technologies such as laser diffraction, image analysis, light scattering and methods for measuring viscosity and rheological properties.

Which industries can profit most from these solutions?

The range of industries served and product types characterized using this group of technologies is vast! In fact, it is difficult to find everyday materials where these measurements will not be applied at some point during a product's development or manufacture. This is why working for Malvern is so interesting (and sometimes challenging too). It is also why the creation of the Malvern PANalytical brings so many opportunities as well.

Can you give us a few examples?

One industry where all the Malvern solutions come together is in the pharmaceutical industry, and this is also a sector where the overlap with the PANalytical solutions is significant. Recent publications suggest that the average cost of developing a new drug product is over USD2.6 billion and that it can take up to 15 years for a product to make it through development and into the hands of a patient.

"Together, our solutions help industries to optimize their production processes and ensure the delivery of effective, safe products."

Paul Kippax, director Product Management Morphology, Malvern PANalytical

Companies developing drug products therefore need to access solutions which can help them understand the purity, solid form, stability and morphology of the active pharmaceutical ingredient the product contains, along with the structure of the formulation. They also need to understand how the formulation is delivered to the patient. Malvern PANalytical's technologies are tailor-made to help companies optimize their drug product development process: the composition can be assessed using X-ray fluorescence (XRF) and the solid form of the drug and other non-active ingredients (excipients) can be characterized using X-ray diffraction (XRD) – these techniques are PANalytical's fields of expertise.

Malvern's technologies, on the other hand, are used to look at the size and shape of the formulation components and also the molecular structure of excipients. We can then link these measurements to important formulation properties which affect the bioavailability of the drug. By controlling more aspects of this expensive development process, a possible failure or a wrong step can be detected in an early stage and thus further costly investment into a wrong direction is avoided.

Another industry where PANalytical's and Malvern's solutions are used together is in the development and manufacture of energy storage systems such as batteries. These days we, as humans, appear to not be able to survive without constant access to mobile technologies such as mobile phones and tablet computers! Accessing these would not be possible without efficient and safe energy storage.

XRD and XRF are used to determine structure and composition of the components used in batteries and to understand what happens during charge/discharge cycles. Measurement of particle size, particle shape, polymer structure and rheological properties can be used to help optimize battery production processes and ensure that energy is delivered from the battery at the correct power.

Together, our solutions help battery developers and manufacturers deliver batteries, which operate safely over as long a time period as possible.

Will the merger with PANalytical bring advantages for customers of both companies?

Malvern and PANalytical have noticed that their respective customers often know of the other company's technologies and are even using them to characterize the same products or processes. This suggests that significant synergies exist. The immediate benefit to customers will be in accessing support and applications expertise, as we now have a larger organization focused on ensuring our customers can effectively apply our solutions.

Both Malvern and PANalytical are already well-known for their excellent collaboration with their customers. The story about our relation with the University of Colorado on the following pages is a good example for this. For the future, we will look to bring value to our customers by applying our solutions together and combine the expertise of both companies to provide customers with the predictive capability they need to streamline product development and ensure product quality. I am very much looking forward to this future!


Paul Kippax

Paul Kippax studied Chemistry at the University of Nottingham (UK) where he also did his PhD in Physical Chemistry. He started his career at Malvern Instruments in 1997 as a product technical specialist before moving to become laser diffraction product manager in 2002.

Since then he has moved on to lead the product management group responsible for identifying new market opportunities for Malvern's Micrometrics, Nanometrics and Macrometrics product portfolios. In January 2017 he was appointed director of Product Management Morphology.

John Carpenter (4th from the left) with his research team and visitors

Working together to create safer biopharmaceutical products

John Carpenter is a professor of Pharmaceutical Sciences and co-director of the Center for Pharmaceutical Biotechnology at the Skaggs School of Pharmacy and Pharmaceutical Sciences. His laboratory researches therapeutic protein products and the causes and control of aggregates and particles which may be formed during manufacturing, shipping, storage and delivery to patients. This research helps guide improvements in product quality and reductions in patient adverse reactions to biopharmaceutical products, and it assists the development of rapid and rational formulation strategies for product stability optimization.

Particles in the samples analyzed by the team are commonly protein-based, but may also be generated by the shedding of contaminant materials into the protein solution from processing equipment, final drug product containers and delivery systems such as intravenous (IV) administration setups.

For the characterization of all sizes of aggregates and particles, from soluble oligomers to nanoparticles, to microparticles through to visible particles, John's laboratory makes use of a wide range of Malvern instruments, including: NanoSight (nanoparticle tracking analysis), MicroCal VP-Capillary DSC (differential scanning calorimetry), Archimedes (resonant mass measurement), Morphologi G3-ID (automated static image analysis twinned with Raman spectroscopy), and Viscotek SEC-MALS (size exclusion chromatography with multi-angle light scattering). Malvern Instruments' systems have enabled John's team to make significant advances in characterizing particles, especially those in the subvisible range, in protein drug delivery systems.

> **"We not only benefit from the expert guidance and advice we get from our Malvern collaborators but we also have a lot of fun working together."**
>
> *Prof. John Carpenter, co-director of the Center for Pharmaceutical Biotechnology*

One key issue is the analysis of particles in therapeutic protein products prepared in prefilled syringes, a storage and delivery mechanism rapidly growing in popularity because of its ease of administration.

Silicone oil is typically used to lubricate the barrels of these syringes, causing microdroplets of oil to shed into the formulation. These oil droplets are often very difficult to distinguish from protein particles and aggregates.

However, by using the Archimedes instrument, John's team saw that the populations of silicone oil droplets and protein particles could be measured independently, enabling the quantification of each type of particle. These data provide valuable and unique insights into product quality and some of the key factors affecting protein particle formation.

In another study, the team found that multi-angle light scattering (MALS) detection during size exclusion chromatography (SEC) was critical for determining that a protein formulation in a syringe configuration was starting to form aggregates during storage, something that could not be verified using UV detection alone.

One of the latest additions to the team's biophysical characterization toolkit is a Malvern MicroCal PEAQ-DSC (differential scanning calorimeter), which is being used to measure protein thermal transition temperatures and to directly compare the thermal stabilities of a range of candidate biopharmaceutical and biosimilar molecules and formulations.

"We have been fortunate to have a long-term collaboration with Malvern Instruments, in which we work together on the applications of state-of-the-art instruments and the development of guidance for best practice for the characterization of therapeutic protein samples.

"We benefit from this relationship, not only because of access to the newest and best instruments, but also because of the expert guidance and advice we receive from our Malvern collaborators. And we have a lot of fun working together!", says John Carpenter. "Malvern Instruments' experts are outstanding collaborators and colleagues, and their customer service and assistance are excellent. It is a pleasure to work so closely with so many people at this leading analytical instrument company."

Malvern's Viscotek SEC-MALS 20 at work

University of Colorado
Anschutz Medical Campus

The University of Colorado (CU), USA, founded in 1876, is a system of public universities comprising four campuses: CU Boulder, CU Denver, CU Colorado Springs, and the Anschutz Medical Campus. They are currently educating around 60,000 students between them.

Skaggs School of Pharmacy and Pharmaceutical Sciences was established in 1911 and is one of the schools located on the Anschutz Medical Campus close to Denver. It is home to approximately 2,500 students and faculty members. Core areas of research at the school include pharmaceutical biotechnology, biophysics, toxicology and cancer pharmacology, and pharmaceutical outcomes.

Respirable silica - beyond the lowest limits of detection

Silica or quartz (SiO_2) is one of the most common minerals and is found in many materials such as soil, sand, concrete and landscaping materials. When these materials are cut, ground or drilled, dust is formed, which can contain very small crystalline silica particles. This respirable silica dust can cause lung diseases and ultimately lung cancer, already at concentrations as low as 50 µg/m^3.

There are several standard methods (such as NIOSH7500, OSHA ID-142 or MDHS 51/2) using X-ray diffraction (XRD) to quantify the amount of SiO_2 phases per volume of air sampled directly on the polymer collection filter or on samples, ashed and deposited on silver membranes.

The maximum allowed concentration of respirable silica in the atmosphere at the workplace is under continuous review and lower limits have been proposed worldwide. Consequently the demand for measuring ever lower concentrations at acceptable measurement times is steadily increasing.

For this challenge PANalytical offers a unique solution on their industrial CubiX^3 diffractometer equipped with a Cu tube: a highly sensitive and very fast line detector is combined with the Bragg-Brentano^{HD} optical module, which delivers an unmatched peak-to-background ratio.

“This robust turnkey solution pushes the limits for the quantification of respirable silica”, says Olga Narygina, product manager at PANalytical. ”A five-minutes measurement of the primary quartz peak is sufficient to achieve a limit of quantification (LOQ) of 1 mg! The method can even easily be set up as a fully automatic push-button solution”.

Expertise at your fingertips

New scientific publications prove the efficiency of Claisse® fusion instruments

Two recently published application notes describe the use of TheOx® Advanced fusion instrument to prepare samples for X-ray fluorescence (XRF) analysis.

The publication entitled ‘Inter-position repeatability study on The OxAdvanced using bauxite type samples followed by XRF analysis’ describes sample preparation and subsequent analysis of bauxite samples from a mining operation. Monitoring of the aluminium content together with the concentrations of other minor elements is important to define the grade and value of bauxite ores. For this purpose, the 6-position TheOx Advanced instrument provides highly reproducible glass disks and ensures accurate results for the subsequent XRF analysis.

The metal industry sometimes deals with samples which are challenging to analyze. Partially oxidized samples can corrode the costly platinumware and volatile elements can be lost if not fused properly.

In the application note ‘Determination of silver and volatile elements in metal concentrates samples using lithium borate fusion followed by XRF analysis’, Claisse experts provide their recipes for an easy and fast preparation of tricky samples while taking into consideration the importance of retaining volatile elements.

Both application notes can be accessed via www.claisse.com/expertise.php together with many other publications about various aspects of efficient sample preparation by fusion.

Events calendar 2017

The list shows a selection of events during the next few months where you will find us. Please come by and visit us when you attend any of these events.

24 - 26 July	Iron Ore	Perth, Australia
31 July - 4 August	Denver X-ray Conference	Big Sky, MT, USA
14 August	5th Ore and Mineral Analysis Workshop (OMA)	Belém, Brazil
11 - 14 September	49th Annual Canadian Mineral Analysts (CMA)	Kamloops, BC, Canada
4 – 5 October	Labtechnology	Utrecht, the Netherlands

www.panalytical.com/events

Wilhelm Conrad Röntgen

The story about the more or less coincidental discovery of a new kind of rays, called X-rays, is widely known. But who was the person behind this discovery?

Wilhelm Conrad Röntgen was born on 27 March 1845 in Lennep near Remscheid (Germany) and spent his youth in Apeldoorn (the Netherlands). In 1868 he graduated from the ETH Zürich (Switzerland) as a mechanical engineer, followed by a PhD thesis in 1869, entitled ‘Studien über Gase’. After a number of positions at various German universities he accepted the Physics chair in Würzburg (Germany) in 1888.

Here at the Physics Institute he started examining electrical discharges with high voltage in nearly evacuated glass tubes. On 8 November 1895 he discovered the existence of rays, which could penetrate his hand and display its bones on a fluorescent screen. Röntgen’s first article ‘Über eine neue Art von Strahlen’ was already published in the Sitzungsberichte der Würzburger Physikalisch-Medizinischen Gesellschaft on 28 December 1895. In this article he gave the unknown rays the name ‘X-Strahlen’. This term is used in many languages worldwide, but in German, Dutch and many Eastern European languages these rays are named ‘röntgen rays’ as tribute to their discoverer.

First X-ray of Anna-Bertha Ludwig’s hand

Courtesy of Deutsches Röntgen-Museum, Remscheid (Germany)

Röntgen moved to the University of Munich (Germany) in 1900 and won the first Nobel Prize for Physics in 1901 ‘in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him.’ Despite many offers from other universities, he stayed in Munich until his death on 10 February 1923.

Colophon

Please send your contributions, suggestions and comments to the following address.

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